PATTERNS IN THE USE OF DOMESTIC ENERGY APPLIANCES IN CAMEROON

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Abstract

In Cameroon, the residential sector is the second highest electric energy consumer after the industrial sector, accounting for 30% of total energy consumed. Efforts in the country to reduce energy demand in this sector through the formulation and implementation of energy efficiency measures is hampered by the scarcity of information on domestic energy appliances. In an effort to investigate the energy appliances used in dwellings in Cameroon, this study employed an inventory of 50 urban and 50 rural households in the South West Regional headquarter Buea with an aid of a questionnaire supplemented by an informal interview of participants. The survey had a 70% return rate of the questionnaire. The results of the study revealed that some appliances like mobile phone chargers and television sets were used in both rural and urban areas while other appliances like fridges/freezers and internet routers among others where commonly used in the urban settlements. With the exception of computers, gas and electric ovens, fans, micro waves and fridge/freezers, all the appliances had energy data labeled on them. The findings of this study is not only useful to energy planners in governmental and non-governmental institutions in the country, but as well constitute a good base for further research in the future.

Keywords: *Appliances, energy, Cameroon, domestic dwellings, greenhouse gases*

1 INTRODUCTION

The built environment is recognised for its high energy use. As reported by the Intergovernmental Panel on Climate Change [1], the global building sector accounted for about 32% of final energy use and over 8.8 $GtCO_2$ emissions in 2010, with energy demand from this sector projected to double by mid-century. In Cameroon, the residential sector is the second highest electric energy consumer after the industrial sector, accounting for 30% of total energy consumed [2]. The building sector constitutes an important developmental activity in Cameroon through its role in the provision of shelter and its contribution to economic growth [3]. This sector has grown tremendously, with strong evidence revealed through the housing boom and public construction sites observed in recent times in the country. Based on the International Futures (http://www.ifs.du.edu/ifs/frm_CountryProfile.aspx?Country=CM) statistics, the population of Cameroon is projected to increase from 23.22 million in 2015 to 32.96 million in 2030. Hence, this population increase will have an increased pressure on built environment services. Energy consumption in the residential sector is determined by the number, types and usage pattern of appliances. [4] opined that the growth in energy consumption in buildings could be caused by an increase in appliance ownership. However, the implementation of energy efficiency measures will change the relationship between appliance ownership and energy consumption. The uptake of more energy efficient appliances will consume less energy compared to the inefficient ones. Most households tend to use obsolete and less efficient fairly used appliances imported from developed countries [5], accounting for a variation in power rating of the same electrical equipment between households. This is further exacerbated by a lack of standardisation of household energy

appliances in the country. As the Government of Cameroon seeks to improve on the electricity access situation of its citizens in the long run by commissioning new power plants, it is committed to mitigate climate change through the reduction in greenhouse gas (GHG) emissions as part of her responsibility for being a signatory to the United Nations Framework Convention on Climate Change (UNFCCC). As recognised by the IPCC [1], enhancement in energy efficiency is an immediate effective measure to reduce energy demand and carbon dioxide emissions, while providing adequate planning time for the commissioning of new power plants. However, for efficiency measures to be adequately designed and implemented in the residential sector, detailed knowledge on the number of energy appliances owned by both rural and urban households alongside their energy intensity (based on energy data label) which is a determinant of energy demand is indispensable. Unfortunately, such data for the country is scarce [6]. Studies by [6] on electrical appliances used in Cameroon's dwelling was limited to just 15 households all of which were located in the urban city of Yaoundé, the capital of the country. This study therefore seeks to advance research on the use of electrical appliances in Cameroon by considering both urban and rural households.

This paper aims to investigate energy appliances used in the residential sector of Cameroon using Buea as a case study. Buea is the administrative headquarter of the South West Region and one time capital of Cameroon during the German colonial rule from 1901 to 1909 [7].

2 METHODOLOGY

In this study, a literature review, structured survey and informal interviews were used to acquire knowledge about household energy appliances in Buea. The choice of Buea was based on the fact that it hosts the only Anglo-Saxon University in the country and students make a significant proportion of the town's population constituting a favorable market for second hand energy appliances, evident by the numerous dealers in the town who sell fairly used appliances imported mostly from Europe and America. Furthermore, Buea like any other city in Cameroon is faced with energy challenges especially during the dry season, characterized by frequent power outages that leaves most cities in a state of blackout. To begin, Buea was first of all stratified into rural and urban settlement and 50 households were randomly selected from each settlement making a total of 100 randomly selected households and a questionnaire was administered to each of the selected household. The survey had a 70% return rate of the questionnaires. The conducted survey was aimed at sourcing information on the different types of energy appliances used in the case study area. Where necessary, the questionnaire was supplemented by an informal interview of participants.

3 ENERGY EFFICIENCY IN DEVELOPING COUNTRIES INCLUDING CAMEROON

[8] defined energy efficiency as the ratio between the output of the performance, service, goods or energy, and an input of energy. From his study, [9] identified technological, institutional and financial barriers as the common barriers observed among developing countries that hampers their ability to take up clean energy and technologies. With respect to the institutional barriers, the absence of appropriate government policies and regulations that supports energy efficiency in developing countries is not uncommon. In Cameroon, there are over 30 legislations that are likely to relate to energy efficiency [10] with the principal ones being Law No. 2011/022 of December 14, 2011, pertaining to the electricity sector in Cameroon, and Law No. 96/117 of August 5, 1996 pertaining to standardization [11]. It could be said that these legislations were formulated to address other issues and over time they were adapted to issues related to energy efficiency. For instance, it is worthy to be noted that Law No. 96/117 of August 5, 1996 pertaining to standardization does not specifically refers to standards related to energy efficiency (European Union Energy Initiative Partnership Dialogue Facility, 2014). Law No. 2011/022 of December 14, 2011 regulating the electricity sector mandates the institution in charge of energy to organize electricity management as well as the conditions necessary for the implementation of the national energy management program [10]. It is likely that the regulations related to energy efficiency in Cameroon are inadequate in addressing energy

related issues in the country like energy poverty since they were originally not designed and implemented to purposely address such issues. There is therefore need for a law specific to energy efficiency to be voted, promulgated and implemented in Cameroon as recommended by [2]. These policies will not necessarily improve energy efficiency, if current knowledge about household energy appliances and their characteristics are not known. Energy efficiency measures will ensure the use of lesser energy to achieve the same outcomes and the energy saving will reduce the household's energy expenditure. This partly depends on the quality of the household energy appliances.

4 APPLIANCES AND ENERGY EFFICIENCY

A range of energy appliances are used in dwellings and the types of appliances used may vary from country to country. As revealed by studies conducted in Zambia, the most used energy appliances in residential dwellings includes; fridge, television, energy saving bulb, fluorescent bulb, candle, charcoal, electric kettle, geyser, electric pressing iron and electric stove [12]. As opined by [12], charcoal, charcoal iron, candle and non-energy saving bulbs were used in informal settlement with low household income while the other appliances are widely used in medium income households. This is indicative that household income is a determining factor that influences the type of appliances used in a household. In most cases, the energy appliances used in dwellings of developing countries are of low efficiency. This is not uncommon owing to the high levels of poverty in developing countries which is likely to make energy efficiency measures not a priority [12]. Appliances used in the residential sector of developing countries are often obsolete and inefficient. As opined by [5], most households tend to use obsolete and less efficient energy appliances due to the cost associated with energy efficient ones. In addition to the cost, the lack of information on energy efficient technologies and their energy saving potentials stands as a barrier for their uptake in homes. It is not uncommon to find appliances used in Cameroon homes without a label of their power rating and other basic information [6]. This is not uncommon owing to the fact that markets of developing countries have been over flooded with second-hand appliances imported from the developed world and the efficiencies and performances of such appliances are in most cases unknown and where known, it is unreliable [5]. Based on the methods described in section 3, the findings of this study will be discussed in the ensuing section.

5 FINDINGS AND DISCUSSIONS

From the survey, the list of appliances used in dwellings in the study area are presented in Table 1. From table 1, it is evident that both electrical and non-electrical energy appliances are used in the study area. Of the identified appliances, gas cookers, and kerosene lamps emerged as the only non-electrical appliance. Some non-electrical appliances are used as a substitute for electrical appliances during a power outage. This is the case with the kerosene lamps which are used for indoor lighting after sunset in the event of a power outage as attested by respondents. All the surveyed households use bulbs for indoor lighting after sunset. Generally, most households tend to use a mixture of fluorescent tubes, compact fluorescent lamps and incandescent bulbs for lighting. Communication appliances like mobile phone chargers were used in all the surveyed households. This finding corroborates with that of [6] who attested that the use of information and communication technologies is common in Cameroon households. As revealed by the survey, the use of heater and air conditioner for space heating and cooling is not a common practice as these appliances were absent in all the households surveyed. The same observation was made by [6] and they attributed this to be likely influenced by favorable climatic conditions. Albeit the presence of electric fans in some households, respondents attested that they are used in the dry season and were currently not used since the months of August-September during which this study was conducted corresponds to the rainy season in Cameroon. This is indicative that the use of some electrical appliances in dwellings is influenced by seasonal factors.

Table 1. Types of household energy appliances.

Appliance[1]	Power rating range (W)	State of purchase	Presence of RED[2]/ADDC[3]	Daily energy demand (kWh)
Fridge/freezer[a]	75-480	Mostly SH[4]	X/12	0.9-5.8
Fluorescent tube[b]	40-60	New	√/6	0.2-0.36
Compact Fluorescent lamp[b]	11-85	New	√/5	0.06-0.43
Incandescent bulb[b]	40-100	New	√/5	0.2-0.5
Pressing iron[b]	750-2400	Mostly SH	√/1	0.8-2.4
DVD (CD+video player)[b]	12-25	New	√/1	0.01-0.03
Television[b]	45-240	Mostly SH	√/10	0.45-2.4
Simple radio[b]	10-15	New	√/4	0.04-0.06
Complete radio (simple radio+DVD)[a]	40-60	Mostly SH	√/2	0.08-0.12
Stereo speaker[b]	30-40	New	√/1	0.03-0.04
Laptop[a]	30-100	New	√/3	0.09-0.3
Mobile phone charger[b]	2-4	New	√/3	0.006-0.01
Electrical kettle[a]	1850-3000	Mostly SH	√/0.5	0.93-1.5
Electrical water coil[a]	30-191	Mostly SH	√/0.5	0.02-0.1
Computer[a]	45-120	Mostly SH	X/2	0.09-0.24
Fan[b]	80-160	Mostly New	X/2	0.16-0.32
Micro wave[a]	260-1600	Mostly SH	X/0.5	0.13-0.8
Gas and electric oven[a]	x	SH	X*/0.5	/
Food blender/mixer[b]	400-700	Mostly New	√/0.5	0.2-0.35
Coffee maker[a]	600-1200	Mostly SH	√/0.5	0.3-0.6
Shaving Machine[b]	16-19	New	√/0.25	0.004-0.005
Internet router[a]	5-13	New	√/12	0.07-0.16
Voltage regulator[b]	15	New	X/14	0.21
Bush lamp[b]	NA			
Gas cooker[b]	NA			

There exists a variation in the number of appliances in the urban and rural settlements. Based on the information obtained from the retrieved questionnaires (40 from the urban settlement and 30 from the rural settlements), all 40 of the urban households and 30 of the rural households owned a television set as indicated in Figure 1 while only 8 of 40 urban households and no rural household owned an internet router. This indicates that a television set could be considered as a basic electric appliance commonly owned by households. Some of the appliances were obtained as brand new while some others were obtained as second hand appliances. As shown on Table 1, bulbs used for indoor lighting, DVD, simple radio, stereo speaker, laptop, mobile phone charger, food blender/mixer, shaving machine, internet router and voltage regulator are usually purchased as brand new items while the other appliances are mostly acquired as second hand goods.

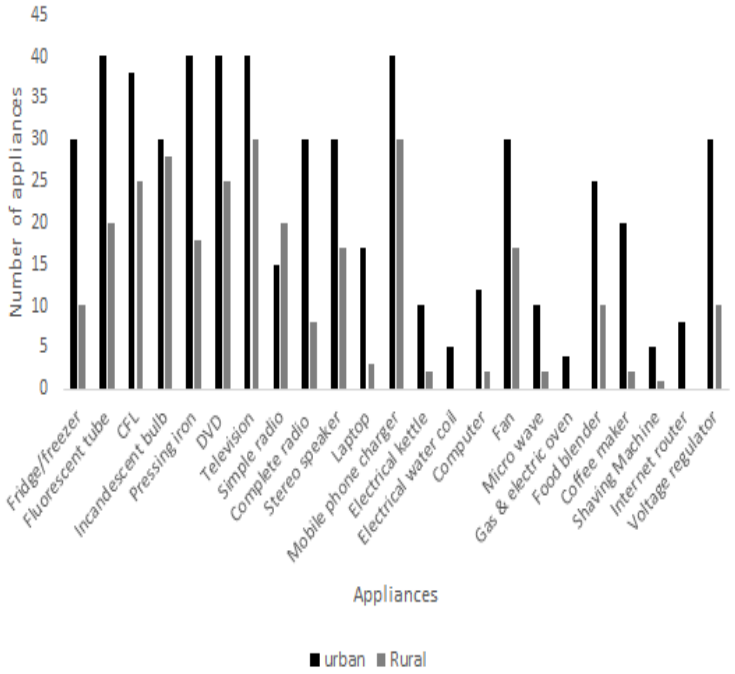

Figure 1. Number of appliances in the urban and rural settlements surveyed

There exists a wide disparity in the power ratings of appliances among households. The power rating of pressing iron for instance ranges from 750-2400W. The same disparity was observed for a similar study conducted in Cameroon by [6]. They noted that the power rating for pressing irons were 176W, 1000W and 2000W for three different households surveyed. The energy data

[1] a: commonly used in urban settlement households, b: commonly used in all households

[2] RED: reliable energy data, X: energy data unavailable on the appliance surveyed in some households, √: energy data labeled on appliance surveyed in all dwellings, X*: energy data (including brand name and model) unavailable for the appliance surveyed in all dwellings.

[3] ADDC: Average daily duty cycle in hours

[4] SH: second hand

of some appliances including but not limited to fridge/freezer, computer and micro wave were unavailable. The Model of the appliances without a power rating was noted and their respective power rating was obtained through an internet search. As indicated in Table 1, fridge/freezer among other appliances are commonly used in urban settlements while appliances like mobile phone chargers and television among others are common to households in both rural and urban settlements. The difference in the ownership of appliances that exists between households of rural and urban settlements could be as a result of a variation in income, with urban households more likely to afford more energy intensive appliances. This is supported by the findings of [12] which shows a variation in the ownership and use of household energy appliances between informal settlement and middle income households.

6 CONCLUSIONS

This study started with a background which dwelt on the challenges of climate change, energy consumption related emissions and a rationale for the need of information on household energy appliances in Cameroon. Subsequently, a methodology for the study was presented after which issues of energy efficiency in developing countries were highlighted. Appliances and energy efficiency were also looked into meanwhile the results have been examined. Considering the fact that data on household energy appliances is scarce in Cameroon, the findings from this study will constitute a basis for further research in this area. Based on the information of household energy appliances', studies on key indicators such as household energy demand and greenhouse gas emissions emanating from dwellings can be conducted. However, detailed information on the consumption pattern of these appliances will be needed. The list of appliances and their power ratings could be used to validate household electrical appliances used in Cameroon obtained from subsequent studies. This study was not without challenges. The very first challenge is associated with the reluctance of some respondents to provide information (power rating) of the energy appliances owned by their households. This was partly because some of the appliances were placed at a position in the house which made it difficult for their power rating to be obtained from the back of the appliance. Secondly, the power rating of some appliances were unavailable as was the case with the gas and electric cooker. This is indicative of the fact that the appliance is either too old or was obtained from a source that is doubtful. It is therefore recommended for subsequent studies in this area to include the use of an ampere meter for the determination of the power rating of household appliances. More research should be conducted in this area pertaining to the consumption pattern of the appliances by the households, household energy reduction and carbon savings.

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